Lithographic characterization of the ETS Set-2 optic at the Advanced Light Source static microfield exposure station

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While interferometry is routinely used for the characterization and alignment of lithographic optics, the ultimate measure of performance for these optical systems is the transfer of an image or pattern into photoresist. Simple yet flexible exposure systems play an important role in this task because they allow complex-system-dependent effects to be deconvolved from the printing results. This enables the most direct lithographic evaluation of the optical system under investigation. To address these issues for commercial-class EUV optics, a static microfield printing capability has been implemented at a synchrotron radiation facility at Lawrence Berkeley National Laboratory (the Advanced Light Source). Installed on the EUV-interferometry beamline, this system has been used to lithographically characterize the 4-mirror optical systems designed for the EUV Engineering Test Stand (ETS) prototype stepper.

The ability to generate the proper illumination conditions is crucial to relevant lithographic characterization. In general, lithographic systems typically operate with a partial coherence or pupil fill of 0.7. However, in practice, it is often desirable to be able to vary the pupil fill. Additionally, the complexities involved in designing and fabricating large field EUV illuminators often leads to unconventional pupil fills. To enable experiments with arbitrary pupil fills, the static microfield exposure station has been equipped with a programmable pupil scanning illumination system.

The microfield exposure station has been used to lithographically characterize the static imaging performance of the ETS Set-2 optics. Various performance metrics have been studied including resolution limits, linearity, contrast, process latitude, and illumination-dependent effects. Additionally, the system has been used for a variety of programmed-defect tests including both pattern and substrate defects.

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